Integrated modelling in Denmark: Current applications and research projects

Vezzaro, Luca; Mikkelsen, Peter Steen

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

WWTmod 2012

Integrated modelling in Denmark: Current applications and research projects

L. Vezzaro[1,2], P.S. Mikkelsen[1]

[1] Department of Environmental Engineering (DTU Environment), Technical University of Denmark, Kgs. Lyngby, Denmark

[2] Krüger A/S, Søborg, Denmark

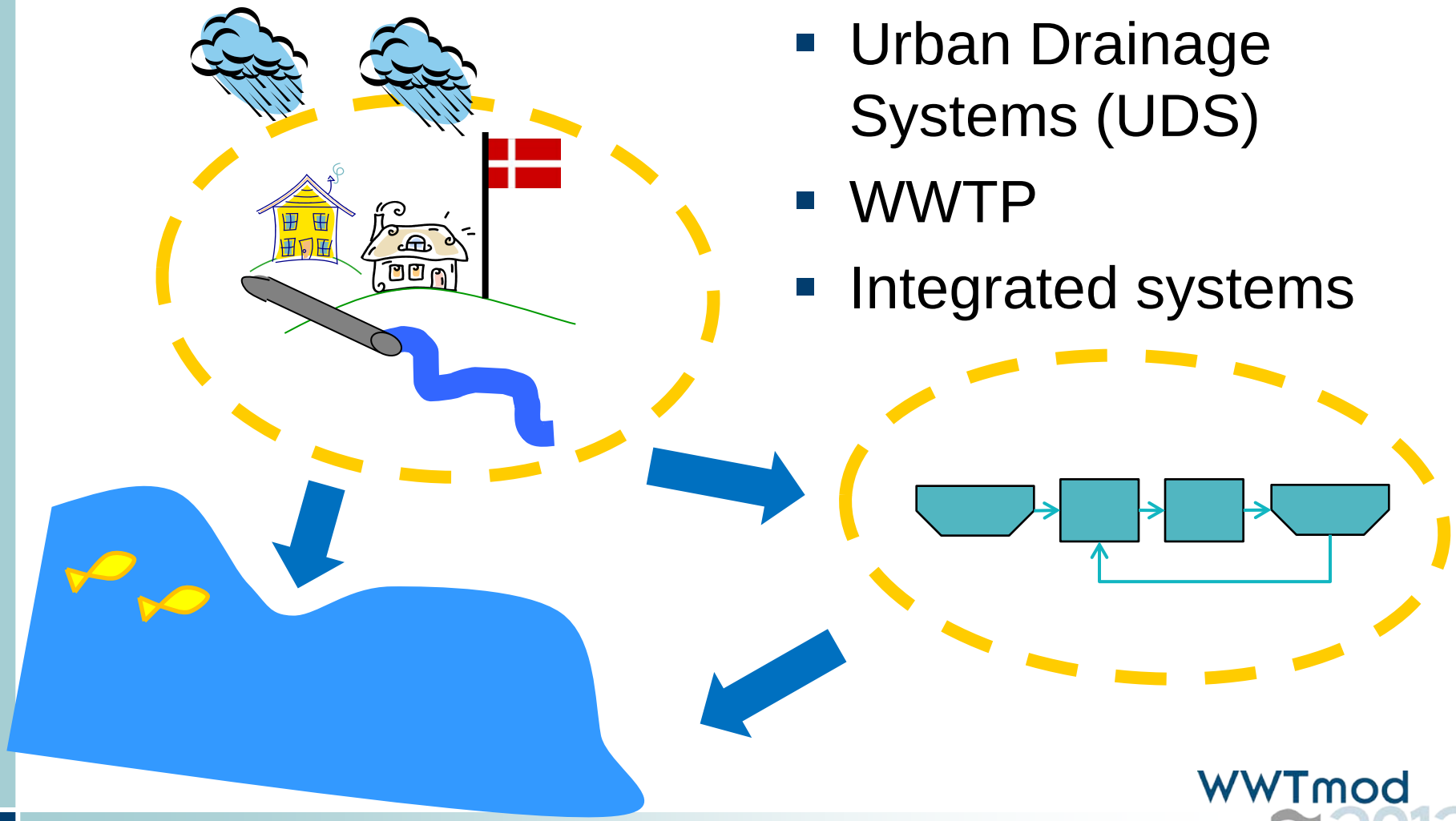
International Water Association

3rd IWA/WEF Wastewater Treatment Modelling Seminar
Mont-Sainte-Anne QC, Canada, February 26-28, 2012

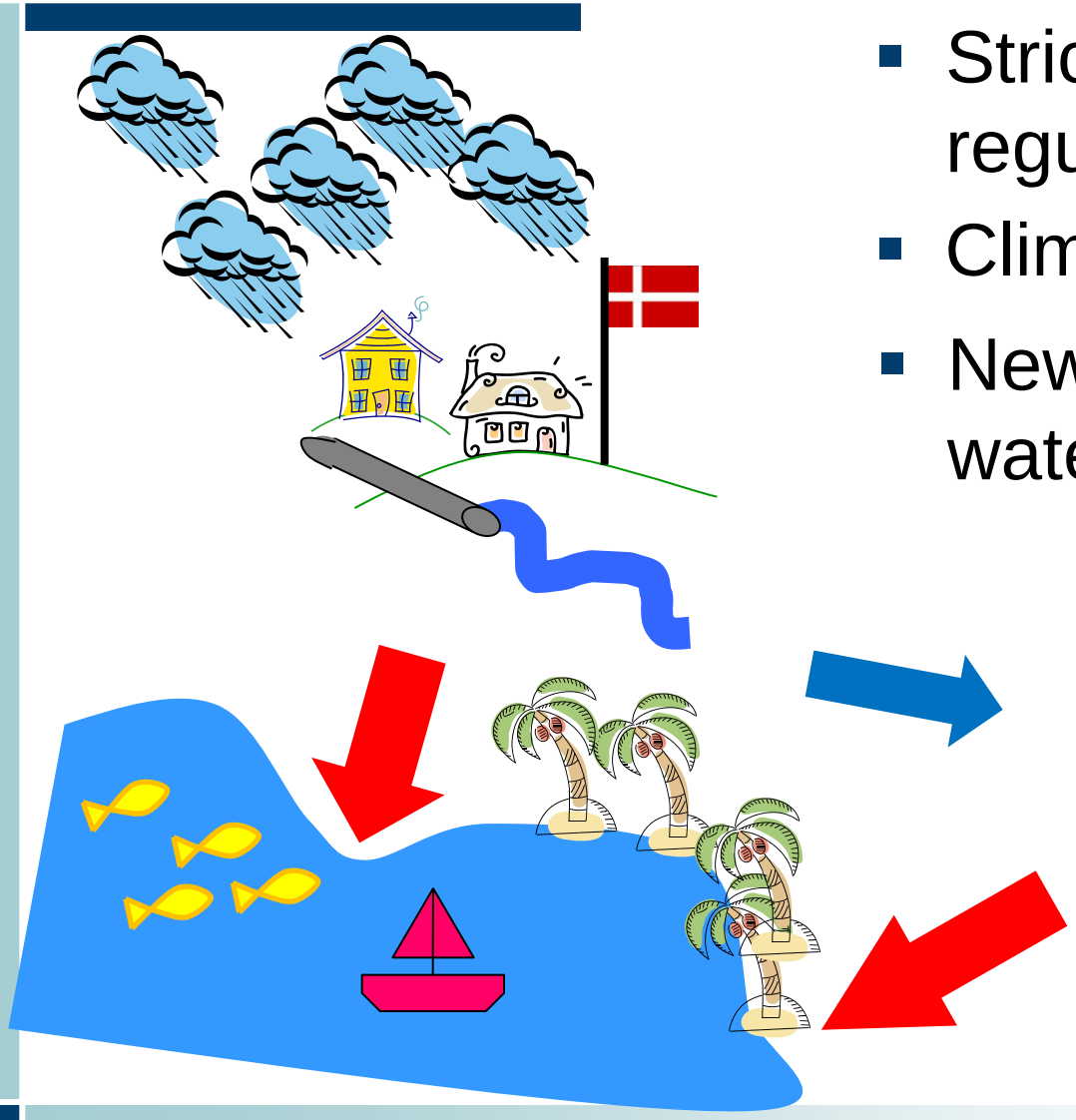
Water Environment Federation®
Preserving & Enhancing the Global Water Environment

Modelling and control in the past

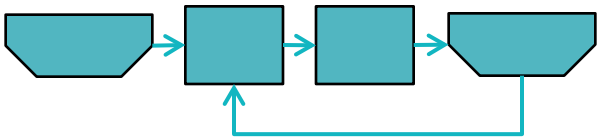
- Long experience in
  - Urban Drainage Systems (UDS)
  - WWTP
  - Integrated systems



New drivers for IUWS control



- Stricter environmental regulations
- Climate change
- New values to receiving waters

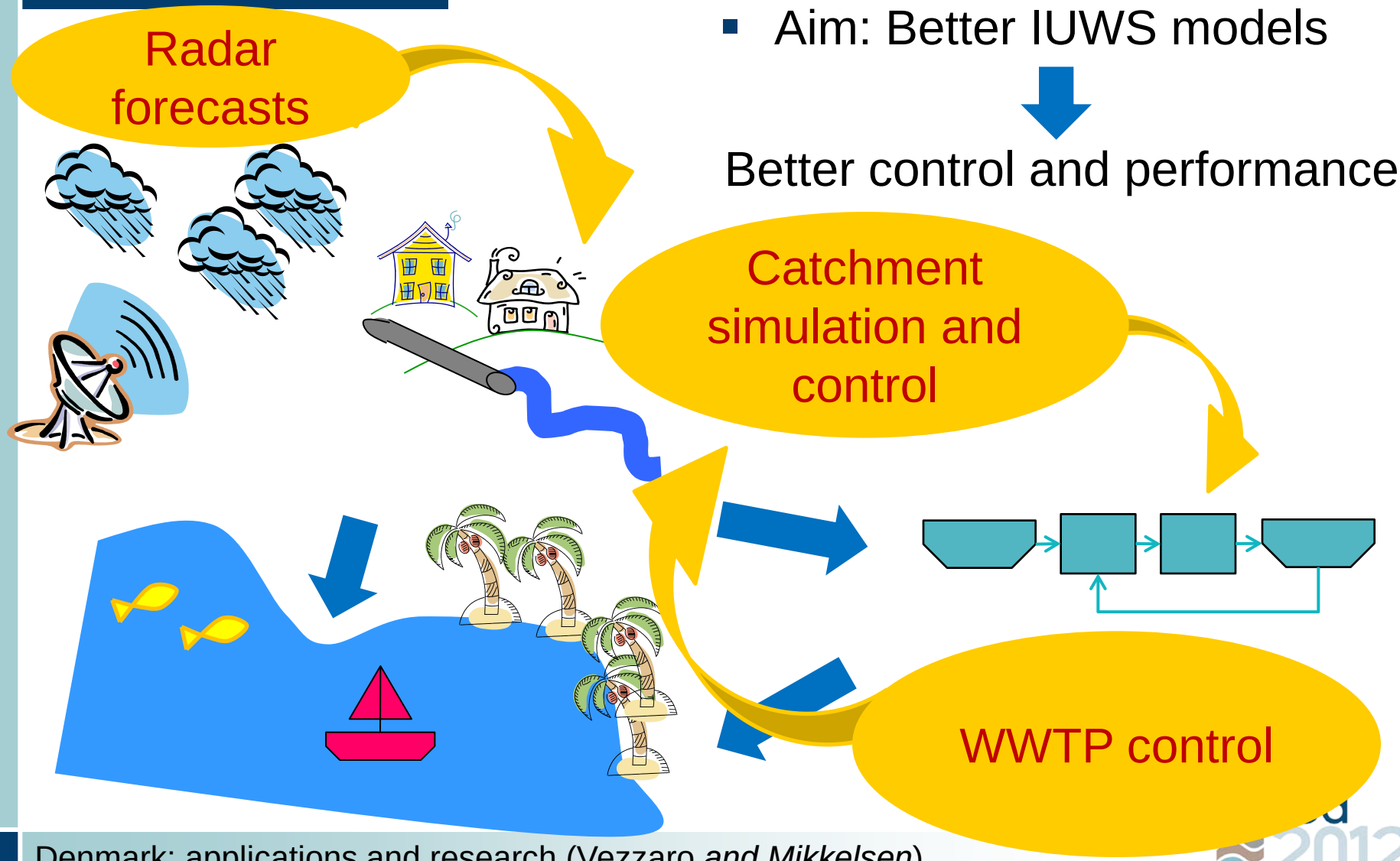


Storm- and Wastewater Informatics (SWI)

Storm- and Wastewater Informatics

- Aim: Better IUWS models

Better control and performance

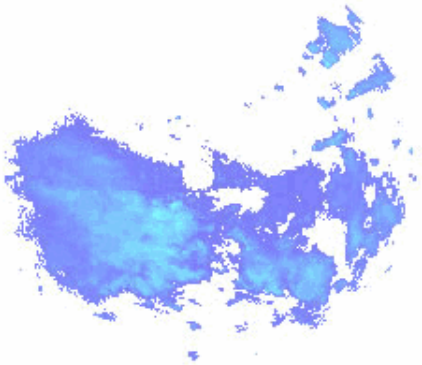


Denmark: applications and research (Vezzaro *and Mikkelsen*)

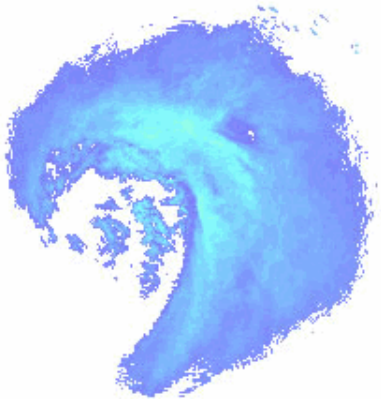
SWI study areas
Radar based forecasts

- Coupling of X-band and C-band radar for forecast prediction *(Jesper Ellerbæk Nielsen)*

Stratiform event



Cyclonic event



Convective event

Problems for IUWS performance

Low

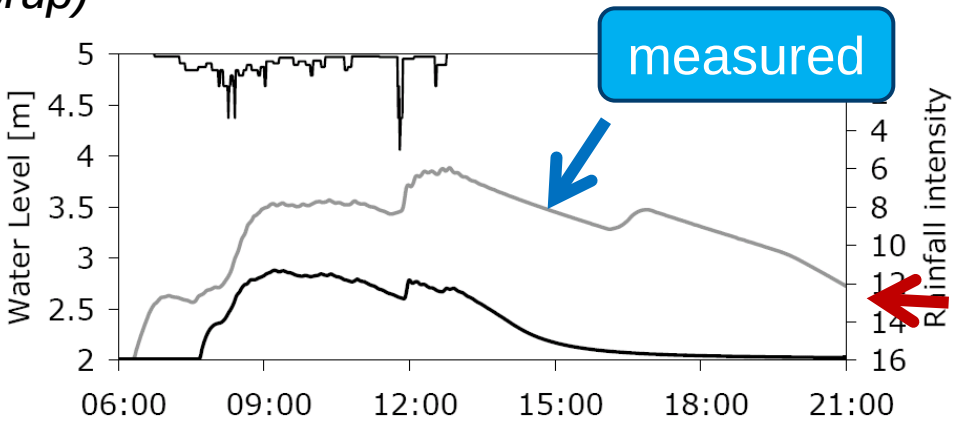
Uncertainty in model predictions

High

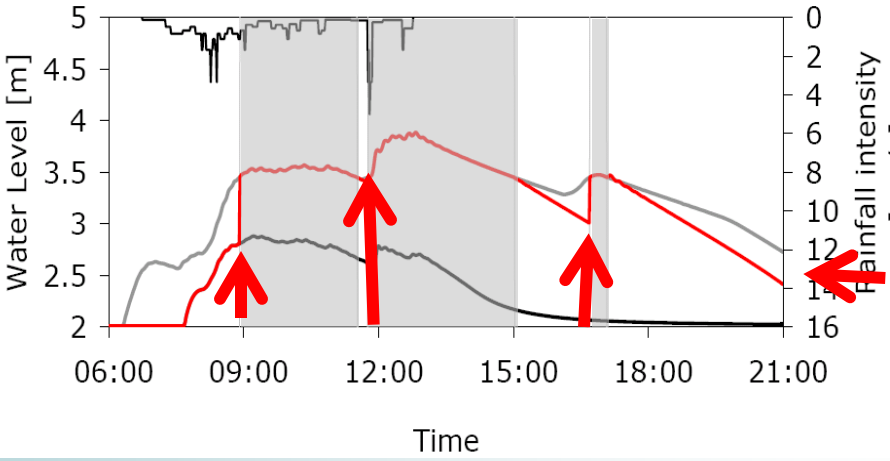
SWI study areas
Urban drainage models

- Data assimilation in urban drainage models *(Morten Borup)*

before



after

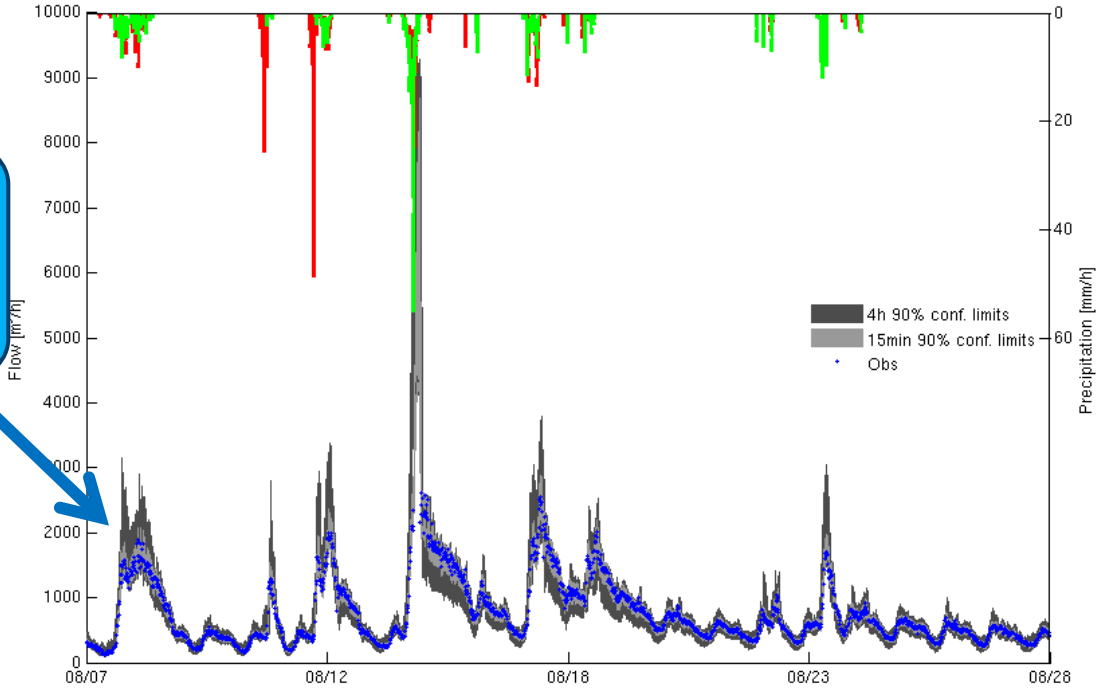


Denmark: applications and research (Vezzaro *and Mikkelsen*)

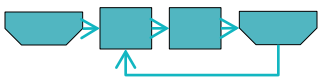
SWI study areas
Urban drainage models

- Grey-box models for flow forecasts *(Roland Löwe)*

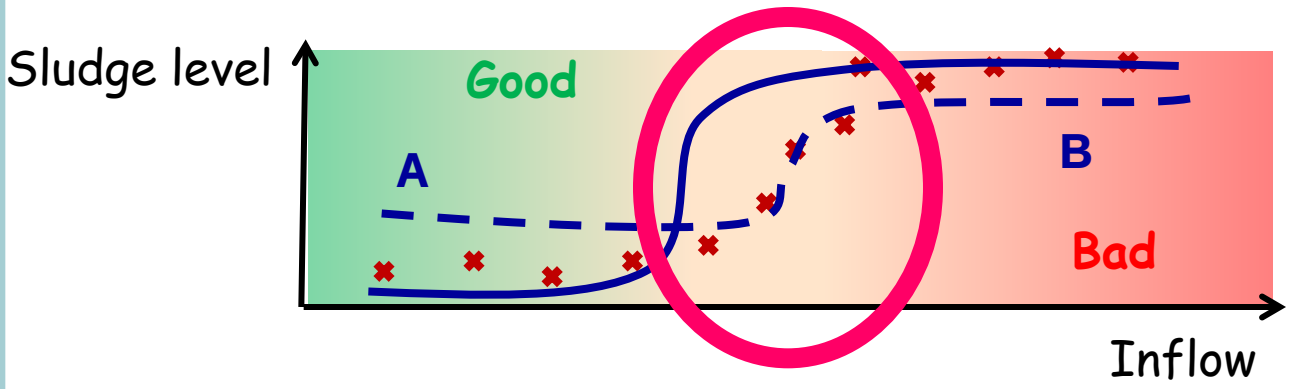
Probabilistic estimation of uncertainty bounds



SWI study areas
Clarifier models

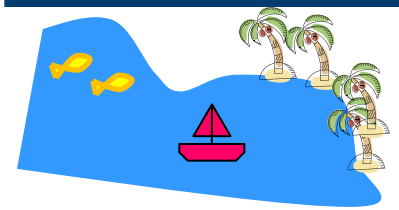


- Better models for sludge blanket *(Elham Ramin)*



Which model is better? A or B?

SWI study areas
Risk analysis



- Quantitative microbial risk assessment *(Signe Tanja Andersen)*

What is the quality during rain events?

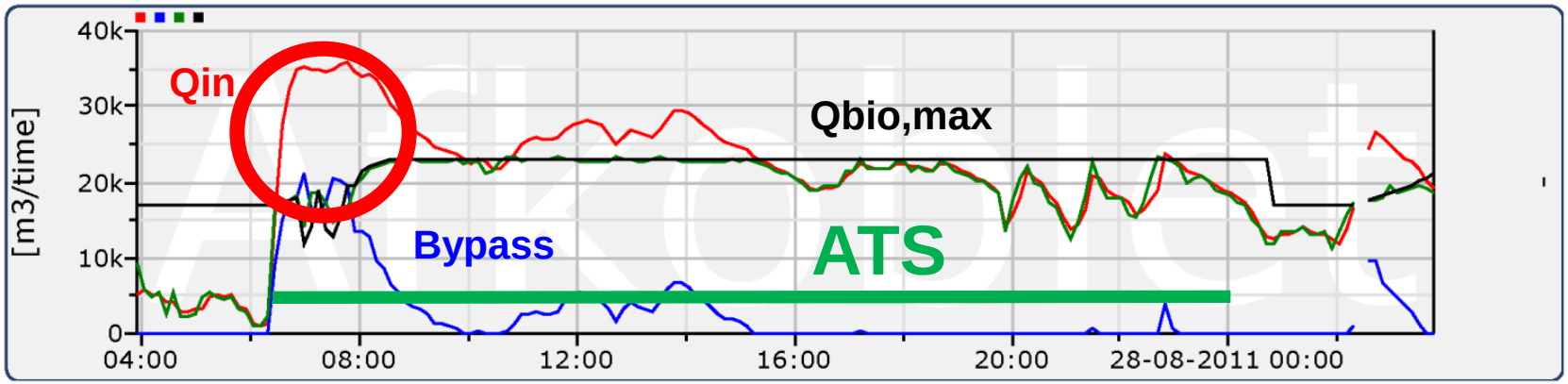
Benefit of IUWS integrated modelling

example from Lynetten in Cph, with Aeration Tank Settling

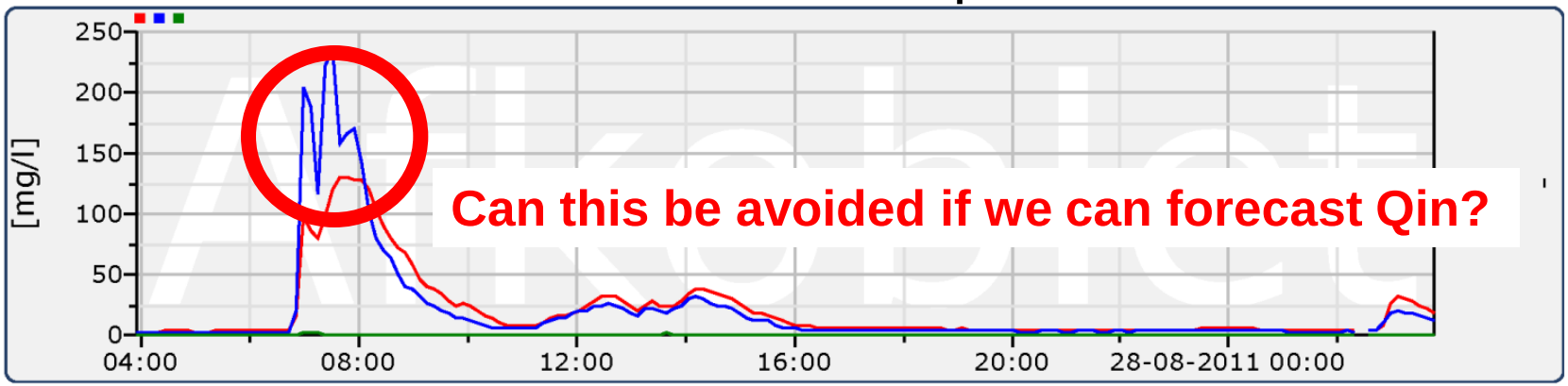
KRÜGER

Lynettefællesskabet I/S

Inflow to WWTP



SS in settler output

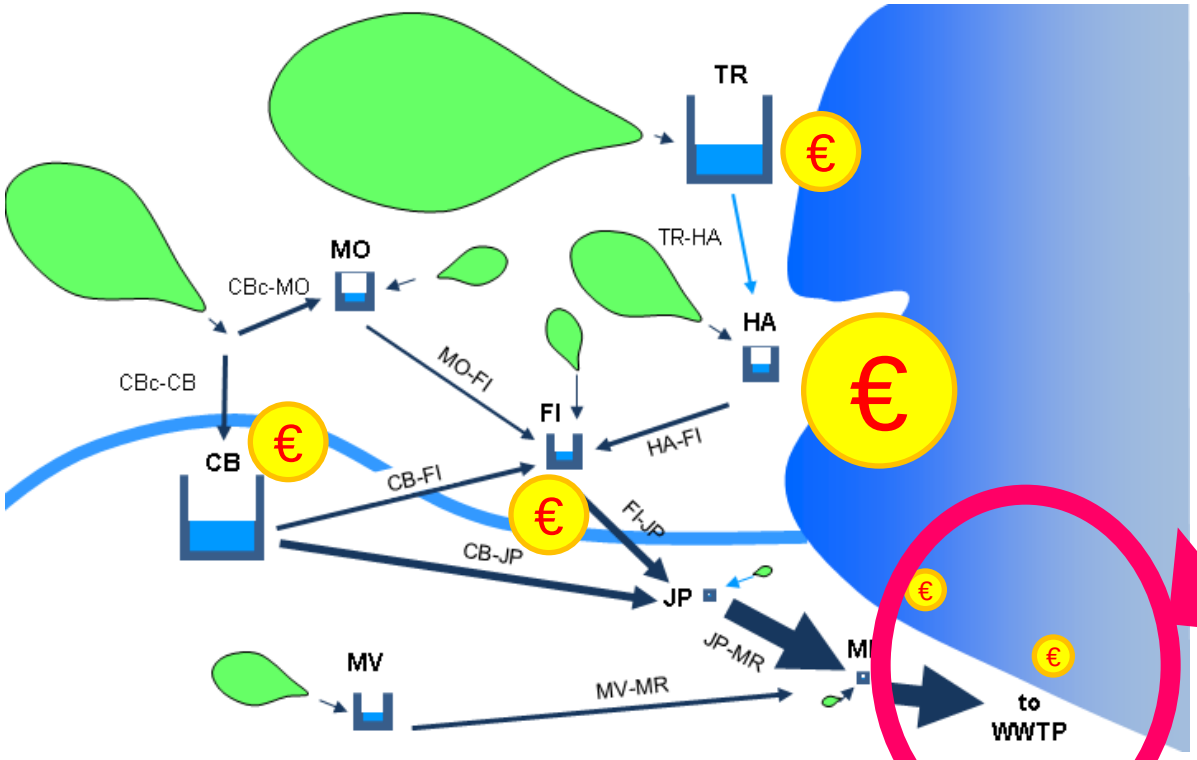


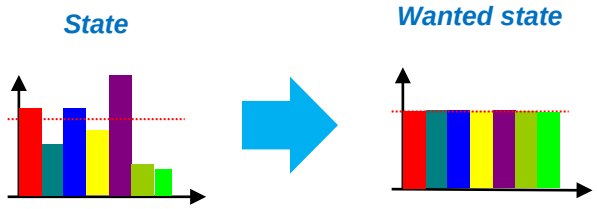
Benefit of IUWS integrated modelling

Model Predictive Control of Marselisborg catchment (Aarhus)

KRÜGER

Runoff forecast + Uncertainty = Less overflows in sensitive points





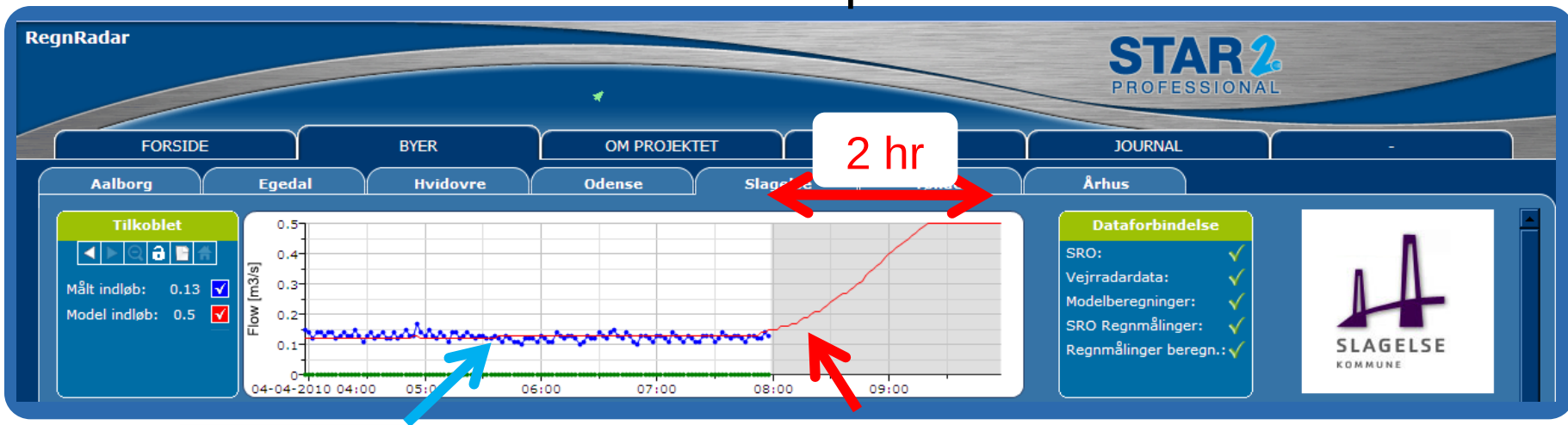
How much water can I send downstream to the WWTP?

How good are we?

Radar-based runoff forecast as input to WWTP

KRÜGER

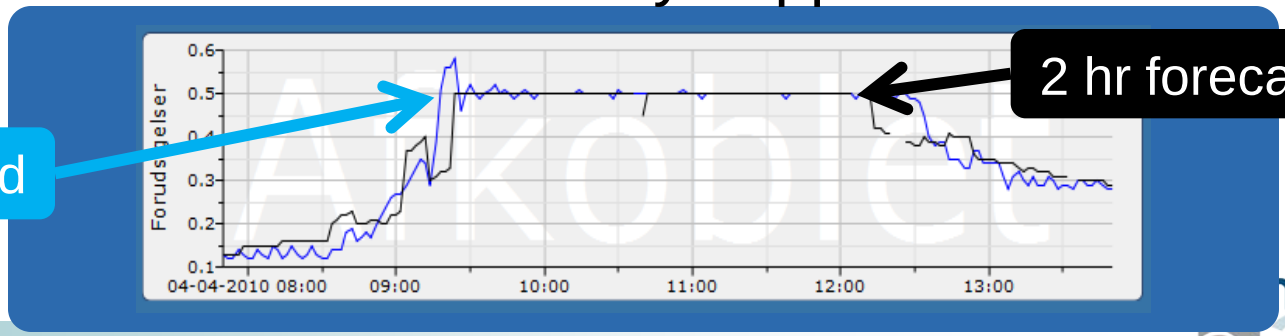
What the model predicts



measured

modelled

What actually happened

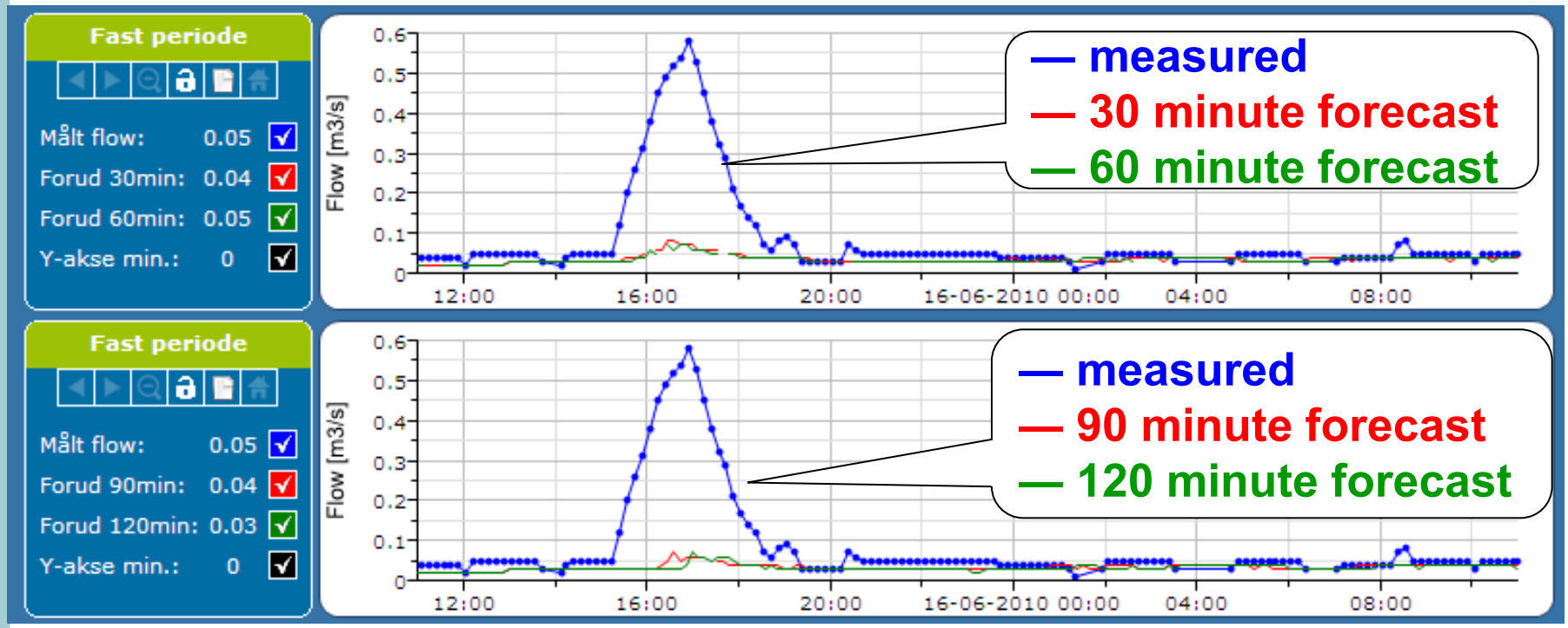


How good are we?

Not always things go well...

KRÜGER

Inflow to Hvidovre WWTP (15-06-2010)



Uncertainty in radar-based forecasts

Foto: Oliver Winther

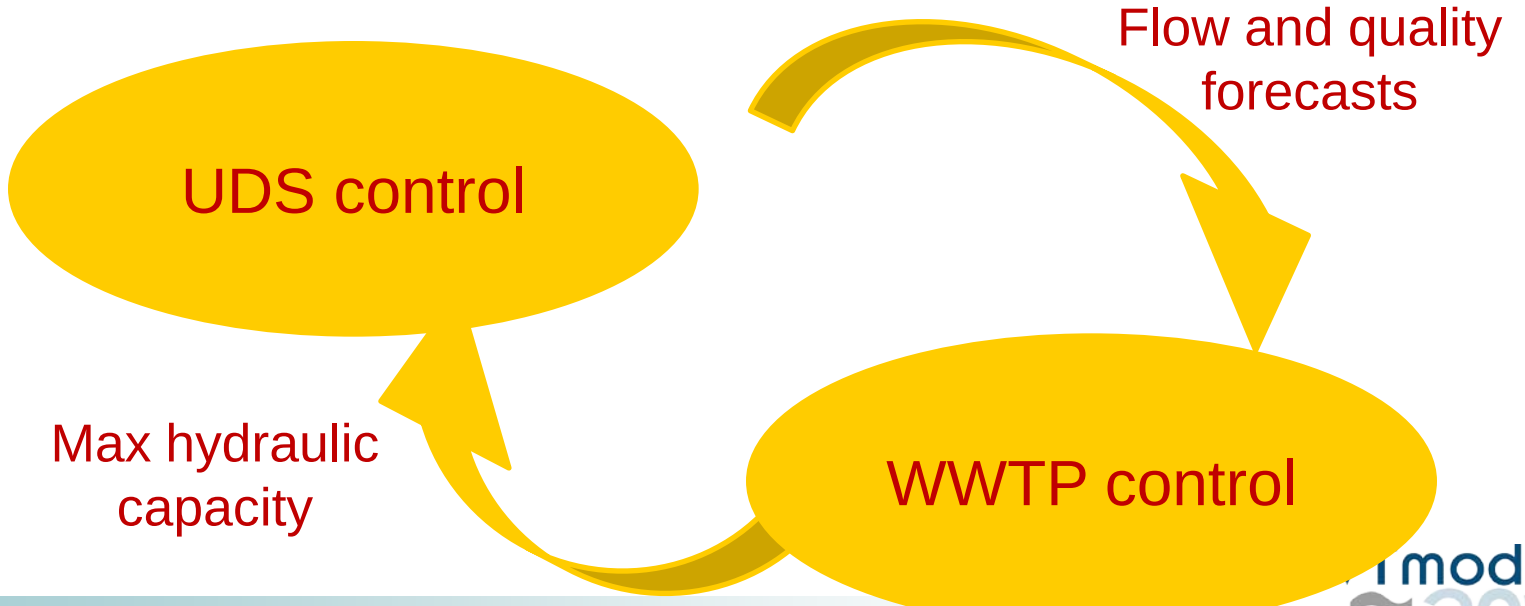
Hagl i Dragør på Amager den 15/6 2010.

Foto: willy jensen

Haglvejr på Amager den 15/6 2010.

Integrated real time control of UDS and WWTP

- Potential of reducing environmental impacts through integrated control of SS and WWTP
- Great potential for developments



Several implementation in Denmark

- Several WWTP are equipped with advanced RTC

Storm- and Wastewater Informatics

Methods and knowledge (research)

- Intelligent Wastewater handling (implementation)
  - Radar (3) + catchment (28 km^2 - MOUSE) + WWTP (700.000 PE – WEST)
- METSAM (demonstration)
  - Global RTC based on uncertainty
- Integrated control of drainage and WWTP/ PREPARED (implementation)
  - Radar + catchment + WWTP + receiving water (river and sea)

Conclusions

- A lot of theory, but few applications (so far)
- New knowledge from SWI project
- Several demonstration projects are on their way
- A lot of new tools and examples from Denmark!

SWI partners

www.swi.env.dtu.dk